Exemption No. 7625

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
RENTON, WASHINGTON 98055-4056

In the matter of the petition of **Cessna Aircraft Company** For an exemption from § 25.785(b) of Title 14, Code of Federal Regulations	**Regulatory Docket No. FAA-2001-9982**

PARTIAL GRANT OF EXEMPTION

By letter L178-61-01-1406, dated May 21, 2001, Mr. Nick Anderson, Section Chief, Cessna Aircraft Company, One Cessna Boulevard, P.O. Box 7704, Wichita, Kansas 67277-7704, petitioned for an exemption from the general occupant protection requirements of § 25.785(b) of Title 14, Code of Federal Regulations (14 CFR). This exemption, if granted, would permit the installation of a multiple-occupancy, side-facing divan in the Cessna Model 680 Sovereign airplane.

The petitioner requests relief from the following regulation:

> Section 25.785(b), Amendment 25-64, requirements for general occupant protection for occupants of multiple place side-facing seats that are occupied during takeoff and landing.

The petitioner's supportive information is as follows:

> "The Cessna Model 680 is fitted with an optional two-place side-facing couch installed in the cabin area opposite to the entry door. Per the certification basis of the Model 680 (14 CFR part 25, Amendments 1-98), the side-facing couch is required to comply with

the general occupant protection requirements of 14 CFR 25.785(b). However, the pass/fail injury criteria of these requirements were primarily developed for forward and aft facing seats and the FAA has determined that the existing regulations do not provide adequate or appropriate safety standards for occupants of side facing seats. For this reason the FAA has indicated that the only certification method available for side-facing sofas, in aircraft that include Amendment 25-64 in their certification basis, is through an exemption from the general injury requirements of 14 CFR 25.785(b).

"DISCUSSION

"Amendment 25-64 of 14 CFR part 25 was issued June 16, 1988, to revise the emergency landing conditions that must be considered in the design of an airplane. Amendment 25-64 revised the static load conditions in § 25.561 and added a new § 25.562 that required dynamic testing of all seats approved for occupancy during takeoff and landing. The intent of Amendment 25-64 was to provide an improved level of safety for occupants on transport category airplanes. Because most seating is forward facing on transport category airplanes, the pass/fail criteria developed in Amendment 25-64 focused primarily on these seats. Side-facing seating installations were not adequately taken into account for transport category airplanes when this amendment was promulgated. Therefore, in November of 1997 the FAA issued Memorandum 'Side-Facing Seats on Transport Category Airplanes,' and Draft Issue Paper 'Dynamic Test Requirements for Side Facing Divans (Sofas)' in order to address the dynamic certification of side-facing seats. The memorandum and the issue paper introduced requirements for body-to-body contact, TTI [Thoracic Trauma Index], and lateral pelvic acceleration, which were in addition to the existing injury criteria requirements of 14 CFR 25.562(c). The specified conditions are required to be measured during dynamic testing of the side-facing couch and compliance to the limitations to be demonstrated.

"The Model 680 multiple-occupancy side-facing couch will be tested in accordance with requirements based on the referenced FAA memorandum and issue paper. A review of the proposed side-facing couch installation, the proposed injury criteria, the proposed tests, and a statement of public interest are presented in support of this petition for exemption.

"PROPOSED COUCH DESIGN AND INSTALLATION

"The Cessna Citation Model 680 is a 13 passenger + 2 crew, pressurized, low-wing monoplane powered with two pylon mounted Pratt & Whitney PW306C engines. The Model 680 offers an interior arrangement, which includes a side-facing couch installation designed to accommodate two occupants. This couch installs on the RH side of the cabin's forward section, opposite to the entry door (reference Figure 1) [available in the Docket]. The couch is located immediately aft of a barrier, which can be a closet/cabinet or a structural divider. The structure of the couch consists of two identical single seat frames installed side by side. The frames are not connected by any structural component and during dynamic loading there is no structural contact or interaction between the frames. Each occupant seating position is fitted with a restraint system. Each restraint

system consists of a lap belt and a shoulder harness. The lap belts attach to the seat frames, and the shoulder harnesses attach to the airframe. The couch single seat frames are upholstered to make the couch look like a single unit; however, they are structurally two separate assemblies. The couch installation includes a structural armrest located between the occupants, which attaches to the airframe. The couch also includes a structural end closure fitted at its aft end. This end closure attaches to the airframe and floor structure.

"All interior components surrounding the couch installation are flat, and possess rounded edges to protect the occupants from serious injuries. The barrier (closet/cabinet or divider), installed immediately forward of the couch, is not fitted with an energy absorbing foam pad on its aft side. This installation however, will be demonstrated to be in compliance with the occupant injury criteria requirements (Head Injury Criteria (HIC), TTI, Pelvic Acceleration, etc) stipulated in the FAA draft issue paper. Cessna has previously certified (dynamically) single side-facing seating installations with barriers forward of the occupant, which were shown to comply with the same occupant injury criteria and did not include an energy absorbing foam pad on the barrier.

"PROPOSED INJURY CRITERIA AND TESTING

"The following proposed injury criteria and testing represent the minimum acceptable standards, which the side-facing couch installation will be demonstrated to comply in support of Cessna's petition for exemption from the general occupant injury criteria of § 25.785(b). This proposed injury criteria and testing are based on the guidelines presented on the FAA Draft Issue Paper, 'Dynamic Test Requirements for Side-Facing Divans.' The proposed injury criteria and testing are essentially the same as the injury criteria and testing previously approved for exemptions granted to other petitioners.

"PROPOSED INJURY CRITERIA

"(a) Existing Criteria: All injury protection criteria of § 25.562(c)(1) through (c)(6) apply to the occupants of the side-facing couch. The HIC assessments are only required for head contact with the seat and/or adjacent structures.

"(b) Body-to-body contact: Contact between the head, pelvis, or shoulder areas of one Anthropomorphic Test Dummy (ATD) on the adjacent seated ATD's is not allowed during the tests conducted in accordance with § 25.562(b)(1) and (b)(2), unless it can be proven that the contact is insignificant. Incidental contact of the leg, feet, arms and hand that will not result in incapacitation of the occupants is acceptable. Contact during rebound is allowed.

"(c) Body-to-wall/furnishing contact: If the sofa is installed aft of a structure such as an interior wall or furnishing that may contact the pelvis, upper arm, chest, or head of an occupant seated next to the structure, a conservative representation of the structure and its stiffness must be included in the tests. The contact surface of this structure may be

covered with energy absorbing protective foam if the limits specified for HIC, Thoracic Trauma Index (TTI), and Pelvic Lateral Acceleration are exceeded.

"(d) Thoracic Trauma: Testing with a Side Impact Dummy (SID), as defined by 49 CFR part 572, subpart F, or its equivalent, must be conducted and TTI injury criteria acquired with the SID must be less than 85, as defined in 49 CFR part 572, subpart F. The SID TTI must be processed as defined in Federal Motor Vehicle Safety Standard (FMVSS) Part 571.214, section S6.13.5.

"(e) Pelvis: Pelvic lateral acceleration must not exceed 130g. Pelvic acceleration data must be processed as defined in FMVSS Part 571.214, section S6.13.5.

"(f) Shoulder Strap Loads: Where upper torso straps (shoulder straps) are used for sofa occupants, tension loads in individual straps must not exceed 1,750 pounds. If dual straps are used for restraining the upper torso, the total strap tension loads must not exceed 2,000 pounds.

"PROPOSED TESTING

"For the longitudinal tests, conducted in accordance with the conditions specified in § 25.562(b)(2), a minimum of two tests will be required, as follows:

"1. One test will be required with one SID ATD in the forward most position and Hybrid II ATD(s) in all other positions, with undeformed floor, 10 degrees yaw, and with all lateral supports (armrests/walls).

"2. One test will be required with one SID ATD in the center position and Hybrid II ATD(s) in all other positions, with deformed floor, 10 degrees yaw, and with all lateral supports (armrests/walls). This could be considered the structural test as well.

"For the vertical test, conducted in accordance with the conditions specified in § 25.562(b)(1), Hybrid II ATD's will be used in all seat positions.

"PUBLIC INTEREST

"Cessna Aircraft Company is a major U.S. corporation, which manufactures, sells, and services business transport aircraft to the domestic and international markets. Its manufacturing facilities are mainly located in the United States and its sales and service facilities are located in the United States and other locations throughout the world. The company employs thousand of employees in the United States providing strong support to the local economies where these employees and facilities are located. The recent and present strong economy in the United States has given rapid growth to the manufacturing, sales and support of transport business aircraft. The owners and operators of these business aircraft very often prefer to configure their aircraft interiors to facilitate use of interior space for in-flight conferences and other work not normally accomplished aboard airline aircraft. These interior configurations include side facing seating installations

(sofas). In order to satisfy the customer demands and maintain its marketing competitiveness, Cessna is seeking to accommodate side-facing seating installations in its business aircraft. Doing this without compromising safety, can only increase the sales volume of these aircraft, benefiting Cessna, its employees and the local and national economies they support. Due to the high demand for these business aircraft, it is important that Cessna be granted the regulatory relief requested. The stabilizing effect that Cessna has on the job market is significant and in the best interest of the public. Failure to achieve this goal will result in a significant loss of income for the national economy and will have a negative effect on both domestic and foreign trade for the United States.

"Other petitioners have been granted an exemption from 14 CFR 25.785(b), this includes, but is not necessarily limited to Dassault Aviation (Regulatory Docket No. 29583, Jan. 2000), Bombardier Completion Centre, Inc. (Regulatory Docket No. 29820, Feb. 2000), Galaxy Aerospace Company and NORDAM Group (Regulatory Docket No. 30056, Aug. 2000). These types of exemptions create unfair competition for Cessna, should Cessna be denied this petition.

"Granting this request for exemption to Cessna is in the public interest as it allows the efficient transport of employees, corporate executives and important clientele in an environment that would otherwise be impossible without this relief. It will be demonstrated by the proposed injury criteria and testing that the transport of people on these side facing seating installations (sofas) is safe.

"For the above reasons, Cessna believes that an Exemption to the general occupant protection requirements of 14 CFR 25.785(b) should be granted for the Model 680 Side Facing Couch Installation."

A summary of the petition was published in the Federal Register on July 13, 2001 (66 FR 36822). No comments were received.

The Federal Aviation Administration's analysis/summary is as follows:

Background

The applicant's petition for exemption from § 25.785(b) is based on the FAA Memorandum, Side-Facing Seats on Transport Category Airplanes, dated November 19, 1997. This memorandum provides dynamic test condition requirements and pass/fail criteria for side-facing seats on transport category airplanes.

The FAA Memorandum: Side-Facing Seats on Transport Category Airplanes, dated November 19, 1997, provides:

(1) The dynamic test conditions criteria. In terms of both pulse severity and types of tests currently required, these criteria are also considered directly applicable to side-facing seats. While it is true that the regulation was written with forward- and aft-facing seats in mind, the orientation of the seat does not change the relevant test conditions.

(2) The pass/fail criteria. For these criteria, however, the orientation of the seat may be significant. Injury criteria are currently limited to head, spine, and femur loads. Head impact is evaluated for contact experienced by the head against any aircraft interior installations, and the pass/fail criterion is based on the resultant head acceleration considering all axes of head motion. The lumbar spinal load is an axially compressive load that is primarily evaluated during the 14g, 60 degree test. The femur load is also compressive, and actually has not proved to be critical thus far. For a side-facing seat, other injury parameters may predominate such that evaluation of those parameters may be necessary to provide an acceptable level of safety.

The first consideration for a side-facing seat is the isolation of one occupant from another. That is, occupants should not rely on the impact with other occupants to provide energy absorption; body-to-body impacts are considered unacceptable.

The second consideration for a side-facing seat is the retention of occupants in the seat and restraint system. Addressing this concern may necessitate providing a means of restraint for the lower limbs as well as the torso. Failure to limit the forward (in the airplane's coordinate system) travel of the lower limbs can cause the occupant to come out of the restraint system or produce severe injuries due to the resulting position of the restraint system, and/or twisting (torsional load) of the lower lumbar spinal column.

The third consideration for a side-facing seat is limiting the load in the torso in the lateral direction, where human tolerance differs from that for the forward- or aft-facing directions and where potential injury mechanisms exist. The automotive industry has developed test procedures and occupant injury criteria appropriate for side impact conditions. Their criteria involve limitation of lateral pelvic accelerations and use of the human tolerance parameter "Thoracic Trauma Index," which is defined in 49 CFR § 571.214. Use of the 49 CFR § 572, subpart F, Side Impact Dummy (SID), rather than the 49 CFR § 572, subpart B, Hybrid II Dummy used in the 14 CFR § 25.562 test, is required to evaluate these parameters. This is the best means available, at present, to assess the injury potential of a sideward impact condition. Such an evaluation is considered necessary to provide an acceptable level of safety for these types of seats.

Other potential injury mechanisms appropriate for aircraft seats may exist. However, due to the lack of useful injury criteria for those other potential injury parameters, such as neck loads and lower limb flail, the FAA is not able to specify criteria applicable to those

areas at this time. The FAA considers that such criteria may be appropriate, particularly for multiple occupancy installations, and intends to pursue their further development.

For multiple occupancy seating, the best criteria currently available cannot be said to provide an equivalent level of safety for those occupants. Therefore, the only vehicle available for accepting these installations would be through an exemption from the general occupant protection requirements of § 25.785(a) prior to Amendment 25-72, or § 25.785(b) after Amendment 25-72.

The following summary of the criteria from the FAA Memorandum, Side-Facing Seats on Transport Category Airplanes, dated November 19, 1997, provides the basis of the petition for exemption.

1. Proposed Injury Criteria

(a) Existing Criteria: All injury protection criteria of § 25.562(c)(1) through (c)(6) apply to the occupants of side-facing seating. Head injury criteria (HIC) assessments are only required for head contact with the seat and/or adjacent structures.

(b) Body-to-Body Contact: Contact between the head, pelvis, or shoulder area of one seated Anthropomorphic Test Dummy (ATD) on the adjacent seated ATD's is not allowed during the test conducted in accordance with § 25.562(b)(1) and (b)(2). Incidental contact of the legs, feet, arms and hands that will not result in incapacitation of the occupants is acceptable. Contact during rebound is allowed.

(c) Body-to-Wall/Furnishing Contact: If the sofa is installed aft of a structure such as an interior wall or furnishing that may contact the pelvis, upper arm, chest, or head of an occupant seated next to the structure, then a conservative representation of the structure and its stiffness must be included in the tests. The contact surface of this structure must be covered with at least two inches of energy absorbing protective foam, such as ensolite.

(d) Thoracic Trauma: Testing with a Side Impact Dummy (SID), as defined by 49 CFR part 572, subpart F, or its equivalent, must be conducted and Thoracic Trauma Index (TTI) injury criteria acquired with the SID must be less than 85, as defined in 49 CFR part 572, subpart F. Side impact dummy TTI data must be processed as defined in Federal Motor Vehicle Safety Standard (FMVSS) part 571.214, section S6.13.5.

(e) Pelvis: Pelvic lateral acceleration must not exceed 130g. Pelvic acceleration data must be processed as defined in FMVSS part 571.214, section S6.13.5.

(f) Shoulder Strap Loads: Where upper torso straps (shoulder straps) are used for sofa occupants, tension loads in individual straps must not exceed 1,750 pounds. If dual straps are used for restraining the upper torso, the total strap tension loads must not exceed 2,000 pounds.

2. General Guidelines

(a) All side-facing seats require end closures.

(b) All seat positions need to be occupied for the longitudinal tests.

(c) For the longitudinal tests, conducted in accordance with the conditions specified in § 25.562(b)(2), a minimum number of tests will be required as follows:

(1) One test will be required with one SID ATD in the forward most position and Hybrid II ATD(s) in all other positions, with undeformed floor, 10 degrees yaw, and with all lateral supports (armrests/walls).

(2) One test will be required with one SID ATD in the center seat and Hybrid II ATD(s) in all other positions, with deformed floor, 10 degrees yaw, and with all lateral supports (armrests/walls). This could be considered the structural test as well.

(d) For the vertical test, conducted in accordance with the conditions specified in § 25.562(b)(1), Hybrid II ATD's will be used in all seat positions.

The FAA may refine the compliance criteria for multiple occupancy side-facing seating to establish an equivalent level of safety. This may include additional injury criteria related to neck loads or other injury mechanisms. The guidance will be updated accordingly, and the certification of multiple occupancy seating may be processed with special conditions in lieu of exemptions. Therefore, the FAA does not agree with the petitioner's request for exemption for installation of side-facing seats installed on all Cessna Aircraft Company Model 680 aircraft. The FAA will grant an exemption that will cover airplanes that are manufactured for a specific amount of time. During this time, the FAA may refine the compliance criteria for multiple occupancy side-facing seating.

For the purposes of this petition, the date of manufacture is considered to be the date on which inspection records show that an airplane is in a condition for safe flight. This is not necessarily the date on which the airplane is in conformity with the approved type design, or the date on which a certificate of airworthiness is issued. It could be earlier, but would be no later, than the date on which the first flight of the airplane occurs.

In consideration of the foregoing, I find that a partial grant of exemption is in the public interest and will not affect the level of safety provided by the regulations. Therefore, pursuant to the authority contained in § 49 U.S.C. §§ 40113 and 44701, delegated to me by the Administrator, Cessna Aircraft Company is hereby granted an exemption from the requirements of 14 CFR § 25.785(b) for the general occupant protection requirements for occupants of multiple place

side-facing seats that are occupied during takeoff and landing, in any Cessna Aircraft Company Model 680 manufactured prior to January 1, 2004.

The following limitations apply to this exemption:

1. Existing Criteria: All injury protection criteria of § 25.562(c)(1) through (c)(6) apply to the occupants of side-facing seating. The HIC assessments are only required for head contact with the seat and/or adjacent structures.

2. Body-to-Body Contact: Contact between the head, pelvis, or shoulder area of one Anthropomorphic Test Dummy (ATD) on the adjacent seated ATD's is not allowed during the test conducted in accordance with § 25.562(b)(1) and (b)(2). Incidental contact of the legs, feet, arms and hands that will not result in incapacitation of the occupants is acceptable. Any contact between adjacent ATD's is acceptable during rebound.

3. Body-to-Wall/Furnishing Contact: If the sofa is installed aft of a structure such as an interior wall or furnishing that may contact the pelvis, upper arm, chest, or head of an occupant seated next to the structure, then a conservative representation of the structure and its stiffness must be included in the tests. In most cases, the representation of the structure would be more rigid and have less deflection under load than the actual installation on the airplanes. The contact surface of this structure must be covered with at least two inches of energy absorbing protective foam, such as ensolite.

4. Thoracic Trauma: Thoracic Trauma Index (TTI) injury criteria must be less than 85, as defined in 49 CFR part 572, subpart F. Thoracic trauma index data must be processed as defined in Federal Motor Vehicle Safety Standard (FMVSS) part 571.214, section S6.13.5.

5. Pelvis: Pelvic lateral acceleration must not exceed 130g. Pelvic acceleration data must be processed as defined in FMVSS part 571.214, section S6.13.5.

6. Shoulder Strap Loads: Where upper torso straps (shoulder straps) are used for sofa occupants, tension loads in individual straps must not exceed 1,750 pounds. If dual straps are used for restraining the upper torso, the total strap tension loads must not exceed 2,000 pounds.

7. Seat Positions: All seat positions need to be occupied by ATD's for the longitudinal tests.

8. End Closures: All side-facing seats require end closures or other means to prevent the occupant from translating off of the seat.

9. Longitudinal Tests: For the longitudinal tests conducted in accordance with the conditions specified in § 25.562(b)(2), a minimum number of tests will be required as follows:

a. One test will be required with ATD's in all positions, with undeformed floor, 10 degrees yaw, and with all lateral supports (armrests/walls). For configurations with a wall or bulkhead immediately forward of the forward seat position on the sofa, a SID ATD will be used in the forward seat position and a Hybrid II ATD(s) or equivalent will be used for all other seat locations. For configurations without a wall or bulkhead immediately forward of the forward seat, Hybrid II ATD's or equivalent will be used in all seat locations.

b. One test will be required with Hybrid II ATD's or equivalent in all positions, with deformed floor, 10 degrees yaw, and with all lateral supports (armrests/walls). This could be considered the structural test as well.

10. Vertical Test: For the vertical test, conducted in accordance with the conditions specified in § 25.562(b)(1), Hybrid II ATD's or equivalent will be used in all seat positions.

Issued in Renton Washington, on September 7, 2001.

/s/ Ali Bahrami
Ali Bahrami
Acting Manager
Transport Airplane Directorate
Aircraft Certification Service